

SCIENCE

FRIDAY, NOVEMBER 18, 1887.

THE CLOSING SESSION of the National Academy of Sciences, which was held Friday at Columbia College, was perhaps the most interesting of the series that occupied the greater part of last week. Unfortunately, in view of this fact, the attendance was smaller than on any of the previous days, as several of the members had accepted an invitation from Professor Edison to visit Menlo Park. The session opened with an interesting paper by Prof. W. P. Trowbridge. It has always been a puzzle how the muscular action necessary to keep birds on the wing so long as they often remain could be possible; and Professor Trowbridge explained the recent discovery by his son, which is that birds of prey and some others have the power to lock securely together those parts of the wing holding the extended feathers and corresponding to the fingers of the human hand. The action of the air on the wing in this condition extends the elbow, which is prevented from opening too far by a cartilage, and the wings may keep this position for an indefinite length of time, with no muscular action whatever on the part of the bird. While resting in this way, the bird cannot rise in a still atmosphere; but, if there be a horizontal current, it may allow itself to be carried along by it, with a slight tendency downward, and so gain a momentum by which, with a slight change of direction, it may rise to some extent, still without muscular action of the wings. The professor also believed it quite possible for a bird to sleep on the wing. In discussing this paper, Prof. J. S. Newberry said that he had once shot a bird which came slowly to the ground as if still flying, but reached it dead. He believed that it had died high in the air; but he had never been able to account for the manner of its descent till now, when he found an explanation in the statement of Professor Trowbridge. Professor Newberry read a paper on the future of gold and silver production. Beginning with gold, he said that he had spent a part of nearly every summer since 1855 among the mines of the West, and he believed that the production of the United States was past its maximum. The present annual production amounts to \$30,000,000. In the northern parts of the mountains of the West there is probably gold, and it may be hoped that a considerable contribution to the gold of the world will be made from this region. There are no important deposits of gold in Mexico. The western coast of South America, rich in silver, is poor in gold. It is likely that the ancient inhabitants practically exhausted the supply, and the images of this metal which they buried with the dead have been sought, with some success. The product of Europe is about \$30,000,000 annually, more than three-fourths of which is from the Ural Mountains. We need not expect any such quantities of gold as flooded the world from California, Australia, and New Zealand, but it may be hoped that the present production may be kept up for many years. The problems of silver-production for the future seem to lie wholly within our own country. There has been a production amounting to more than six thousand millions of dollars since the discovery of America, and it is likely to reach from forty to fifty millions annually for some years to come. The mines of Peru and Bolivia are the most famous in the world, and it is estimated that they have yielded \$2,493,268,800. Their yield has been comparatively little for many years. On Wednesday evening Mrs. Henry Draper gave a reception at her home, No. 271 Madison Avenue, to the members of the academy. The leading feature was an account given by Prof. E. C. Pickering, director of the Harvard Observatory, of the work in stellar photog-

raphy under the provisions of the Henry Draper Memorial Fund. A full list of the papers read is given in another column.

AT THE ANNUAL FALL MEETING of the trustees of Princeton, held Nov. 10, Dr. McCosh resigned the office of president, his resignation to take effect at the end of next term. In closing his annual report, Dr. McCosh said, "For several years past I have been sensitive as to whether I may not be continuing in my office to the detriment of the college. I am so far relieved by finding that no such effect has yet followed. Our entrance class this year, 179, is larger than ever it was before; as also our total number of students, 603. It was 264 when I came here, and this while we have gradually been raising our standard of scholarship. Thanks to our generous benefactors, our grounds and buildings, books and apparatus, have been doubled or trebled. But having been in your service for over nineteen years, and being several years above the threescore and ten, the time has come to look to my retiring from the presidency of the college. I see it clearly to be my duty to ask the board to accept my resignation at its next meeting in February, and appoint a successor to me, it being understood that I retain my office till the beginning of the third term. I leave the college in a healthy state, intellectually, morally, and religiously." Dr. McCosh was born in Ayrshire, Scotland, in 1811. Educated in the universities of Glasgow and Edinburgh, he early began to show signs of literary and philosophical talent of a high order. His first serious work, an essay on the Stoic philosophy, obtained for him the honorary degree of M.A., and he was ordained a minister of the Church of Scotland at Arbroath in 1835. In 1839 he removed to Brechin, and from that time he took a prominent part in the disputes which arose in connection with the disruption of the Scotch Church, and the organization of the 'Free Church,' which was effected in 1843. His next work to attract attention was 'The Method of the Divine Government, Physical and Moral,' which was a theological application of Sir William Hamilton's philosophy. In 1851 he was appointed professor of logic and metaphysics in Queen's College, Belfast, and wrote, in collaboration with Prof. G. Dickie, 'Typical Forms and Special Ends in Creation,' and 'Intuitions of the Mind,' which were followed by 'An Examination of Mill's Philosophy.' Dr. McCosh was elected president of the College of New Jersey at Princeton in 1868, and has held that office up to the present time. Among the works he has written in the mean time may be mentioned, 'The Laws of Discursive Thought,' 'Treatise on Logic,' 'Christianity and Positivism,' the 'Scotch Philosophy, Biographical, Expository, and Critical, from Hutcheson to Hamilton,' and his famous 'Reply to Professor Tyndall's Belfast Address.'

THE 'ACT OF GOD' AND THE RAILWAY-COMPANY.

SO far back that memory of man runneth not to the contrary — imported into the very earliest English jurisprudence from the Roman Code — was the theory of Nemesis, of the Inevitable, the Unavoidable. When it reached our motherland and Christian times, and clamored for recognition in the Common Law, our reverent Norman-Saxon lawyers, to be sure, called it the 'Act of God.' But it was the Stoic 'Fate' of the Roman — his 'Nemesis,' his 'Adrastea' — just the same; and the earliest English digests declared that 'the Act of God or of the public enemy' discharged all legal responsibility. In our day the doctrine is oftener laughed at than applied. A Western counsel for a railway-company, who, in defending an action for damages for haystacks destroyed by fire communicated from the company's locomotive, claimed that his

client had no control over the winds of heaven, speedily found himself out of court — his client should have used spark-arresters. But until a very recent date, courts of justice habitually saved time and routine labor by assuming accidents far less remote from their proximate causes than the distance between a haystack and a smoke-stack to be 'Acts of God;' though, indeed, a very recent English court, while recognizing the principle, declared that a shipwreck, to be a veritable act of God, must have happened in extremely bad weather.

But, though to-day in the United States the principle has all but disappeared from our digests, its existence is rather suggested by the somewhat startling fact, that, in all our recent chronicle of railway casualty (and I confine myself to the United States in this paper, because our safety appliances are invariably the latest, costliest, and most elaborate in the world, our corps of watchmen and care-takers the most numerous, and our estimates of the value of human life incomparably the largest), as a rule the simplest accident is the deadliest, and the utmost perfection of life-saving appliances (whose adoption saves in nine hundred and ninety-nine cases in the thousand) may yet turn out to be helplessness itself in the thousandth case when the calamity arrives: in other words, the disaster, when it comes, will be found to consist in the operation of some perfectly familiar law of nature (as of gravitation or inertia), set in motion by the simple oversight of some trained and trustworthy subordinate; which would have resulted from identical causes thirty centuries ago to the most primitive of conveyances equally as well as to our own limited expresses, with their air-brakes, vestibules, and coupler-buffers.

In examination of the history of railway-accidents in the United States, the physical conformation of the country should not be overlooked. As railways were first constructed among us, and had their formative days of operation in the Eastern States rather than among the flatlands and ordinarily easy grades of the Ohio valley, it was only natural that the bulk of experiment, mismanagement, error, and fatality, should have been expended on our Atlantic slopes. The period of the railway in the United States is yet one very insignificant in point of years. To-day, in 1887, the maps of our territory of greatest railway-development have Lake Michigan and the Mississippi, instead of the Atlantic Ocean, for their east. But by the time that railway-construction had begun to extend westwardly from those boundaries, those greatest insurances of safety — the air-brake, the coupler-buffer, the steel rail, the improved means of communication between the engineer, conductor, and his crew, which had been slowly wrought out in the East — had come into practical use. Hence it is that the Pacific railroads, though spanning gorges, climbing summits, and surmounting problems of construction to which the achievements of our Atlantic slope railroads are moderate, have no such records of manslaughter and destruction as we find in the records of Eastern rail-transportation. At present every American railway is equipped — is obliged by law to be equipped — with the last improvement in safety-insuring devices, not only for the convenience of the passenger, but for the safety of the employee against his employer as well as against fellow-employee. And it is an amenity to the credit of the railway system (which ought not to be lost sight of in these days when wage-workers are taught to look upon any thing incorporated as their deadliest foe) that it has introduced into the common law of the land the principle that an employer's duty to his employees is only discharged by furnishing him the safest tools for his work which the strides of science have devised.

Until within a very few months, these strides of science seemed to have happily abolished — in the United States — the great railroad-disasters of the past. Since the frightful catastrophe at Carr's Rock on the Erie Railway of twenty years ago, science and experience have rendered the giddy curves and bold escarpments of its Delaware division as safe as the tangents crossing an Iowa prairie. The Angola and Ashtabula terrors on the Lake Shore Railway wound up practically the list for that line; while, had it not been for a phenomenal piece of silly and unaccountable carelessness at Spuyten Duyvel (when Mr. Wagner, an inventor of parlor-car conveniences, was crushed to death in one of his own coaches), the New York Central would have closed up its own perspective of great calamities at New Hamburg, something in

the neighborhood of fifteen years ago. But this fifteen years of wonderful immunity from great railway-disaster — most wonderful when we consider that it corresponds with an era of railway-building in the United States unparalleled in the history of human industry — has been brought to a termination by a rapid succession of calamities, grouped into a period of ten months, which, in point of loss of human lives (and no other point is worth considering), are, if not the most terrible in railway annals, yet fall little in horror below the Wigan slaughter, or the annihilation at Tay Bridge, of the multiple horrors of which (analogous to those of shipwreck and railwreck combined) no living tongue shall ever tell the story. These five occurred during the first ten months of the present year, (1) on the Baltimore and Ohio Railroad at Republic, Jan. 4, 1887; (2) on the Central Vermont Railroad at White River, Vt., Feb. 11; (3) on the Boston and Providence Railroad at Forest Hills, March 14; (4) on the Toledo, Peoria, and Western Railroad at Chatsworth, Aug. 10; and (5) at Kout's Station on the Chicago and Atlantic Railway, Sept. 12 of the present year. These five are, I think, remarkable not only because breaking in upon the long immunity, but because upon examination it will, I think, be found that they were each and all due, not to any defect of machinery, signals, or other mechanical appliances which the corporation could have supplied, or to any defective or careless management, but to those unaccountable omissions of trained minor servants to perform a perfunctory detail of their routine work — a detail which it was their second nature to perform — which it would have ordinarily required a physical effort for them *not* to perform, or to have kept them from performing; that is to say (for it is difficult to exactly formulate it in words), an instantaneous mental incapacity on the part of a trained workman or care-taker, over which laws, rules, and incorporations have no control, and against the possibility of which neither hope of reward nor fear of loss or punishments can afford any defence or protection whatever. They all occurred on perfectly equipped roads, and from the simplest natural causes. Each of the accidents might have happened to the rudest contrivance of primeval or prehistoric man, — to the cart which used the section of a tree-trunk for a central wheel, or to the hollowed tree-trunk which itself formed a means of water-transportation, as will appear from their recapitulation.

The Republic accident was in this wise: a freight-train, which had ample time to make a run of some dozen miles to get out of the way of a through express coming in an opposite direction, which had made that run easily every night for years, for once failed to accomplish it. All the mechanical appliances and motive power of the train were in perfect order; its crew were old servants of the company. But the weather was exceptionally cold, the water in the tank of the engines was all but congealed, and the crew of the freight-train found themselves encroaching on the time of the express. Here was not only no novel situation, but, on the contrary, perhaps the simplest which can occur in any railway management. There was no emergency to meet. Probably not an hour passes in a day but that, somewhere in the vast railroad operations of the country, the case is paralleled. But here at Republic, on the night of the fourth day of January, 1887, the hand sent ahead with the signal failed to carry it: two trains met. The old catch problem of the irresistible force meeting the immovable body demonstrated itself; namely, the trains were destroyed, and twenty human beings lost their lives.

Just a month later, Feb. 5, came the disaster at White River. A night express thundered upon a bridge, which was supposed to be properly inspected. Every mechanical portion of the train was working as it should; every servant of the company was at his post; nevertheless, the locomotive left the rails instead of following them; the express-train was plunged to the frozen surface of the river fifty feet below; and, of its three hundred passengers, thirty-two never breathed again, or were roasted in slow agony from burning *débris* upon a floor of ice. Every bridge on every railroad-line in the nation is ordered to be watched. A corporation must act by its agents. This bridge had probably been hourly inspected for years, but somebody had failed to inspect it on the fifth day of February, 1887. Another month went by, and on the morning of the 14th of March a packed train on the Boston and Providence Railroad of three hundred mechanics and working-women was

moved into Boston for the day's business. Somebody had failed to report or to discover a flaw in the iron-work of a bridge at a point called Forest Hills. The locomotive followed the rails. Every thing upon the train was in perfect order; no appliance in the company's power to provide was lacking; but the bridge sank. The entire train except two rear cars was piled up in kindling-wood in a defile made by a passing road below; and from the undistinguished mass forty persons were drawn out dead. Four months of absence of great calamity by rail was then to succeed. But on the evening of the 10th of August an excursion party, gathered at Peoria and other points in Illinois, was to be carried to Niagara Falls. There were sixteen cars loaded with excursionists, and two engines were needed to draw them. The ordinary rules were observed, and due notice of the extra movements of such an unusual train was duly wired ahead for the guidance of watchmen and track-walkers. All went regularly; but it seems that a side-fire had been kindled on the right of way for clearing-up purposes, and that some track-walker whose duty it was to watch it had allowed it to communicate to the beams of the wooden bridge at or near Chatsworth. The train reached the bridge, but the bridge was already disabled by fire. It sank as did the one at Forest Hills, and eighty-five passengers were killed, — a most unprecedented death-list for an American railway-accident. Compared to the above, the fifth of these fast-recurring disasters seems almost dwarfed, and yet it was the most wonderful — from the standpoint of our present examination — of all. An engine drawing an express passenger-train on the Chicago and Atlantic Railway became disabled by the breaking of an eccentric strap. The engineer hauled up at a water-tank for repairs. A freight-train which followed, relying upon the schedule which the first train should ordinarily make, ran into the rear of the train with the disabled engine. Nine persons only were killed, — a small list compared with those we have previously noted. But doubtless it is as terrible to the victim to be killed in a list of nine as in a list of eighty. It was the story of the Republic disaster over again. Some brain had failed to do the regular act which it had performed for years as regularly as clock-work.

Now here, in less than nine months, one hundred and eighty-six lives, all precious to their owners if to nobody else, are sacrificed. Nobody but the claim agents of the corporations can ever know the number of wounded and maimed (nor even they, since many of those who escape do not care to press their undoubted claims), and the stockholders of the unfortunate corporation do not care to advertise the dead loss of material which it costs in cash to replace its ruined rolling-stock and transported material, lest the newspapers of the country dilate upon the preference shown for income over flesh and blood, and lash the popular dislike of corporations into fury with the stereotype with which every railway-accident fills our admirable press. But allowing four to one, — a minimum allowance, — nearly eight hundred more human beings have suffered a loss of limb or extreme physical pain, and several hundred thousands of dollars' worth of direct expenses incurred, for every one of these accidents, which should never, in the ordinary course of human procedure, have happened at all.

I say, should never have happened; but where shall the responsibility be placed? By law it is placed, and rightly, so far as human laws go, upon the railway-companies. But every railway-officer knows that the penalty his company suffers for such accidents as the five above described is exemplary, — a vindication only, so far as the companies themselves are concerned. That they have done, were doing at the time the accident happened, all that experience and science had taught them how to do, or that their professional or expert brethren employed in the same industry could have done under like circumstances, they know, and every railroad-man in the country knows, perfectly well. But the railway-official also knows very well, however, and realizes very submissively, that for these accidents he will be held to answer, and *not* before a jury of experts, or of his peers. The newspapers in no one of the above instances fail to ascribe these accidents to the 'greed of corporations.' The 'greed of corporations,' to be sure, is only another name for the duty of every corporation to pay dividends, if they can; and doubtless, were there no such duty or no such chance of payment, there would be no railroads, from the simple disinclination of ordinary

mortals to invest money in costly enterprises without hope of return or increment. But waiving that consideration, certainly it is hedging on the superfluous and the elementary to say that no railway-company courts accidents; that, no matter how large any individual loss by reason of the casualty may be, the company (that is to say, its stockholders collectively) must be the largest losers of all. When Sir James Coke said that corporations had no souls, he did not utter an epigram: he simply stated a fact. A corporation has no sentiments: it is simply put together for business purposes, because a number of individuals see in association the means of investing in a lawful industry too heavy for any one of them to singly handle. An attempt to earn dividends is properly described as 'greed,' of course. But what reader of newspaper denunciation pauses to subtract from any particular year's 'greed,' of any particular corporation, the million of dollars or less that a great disaster like that at Chatsworth or Forest Hills draws out of a company's treasury? Whatever the present state of clamor against corporations may develop, it is at least apparent, from considerations of pure 'greed,' that a railway-corporation is not a Moloch, or a contrivance incorporated for the purpose of burning or mutilating human beings, or crushing their bones, or mangling their limbs. Philares is said to have built a hollow bronze ox in which to roast his subjects for fun, and the druids to have made wicker cages in which to burn as many living babies as possible for economy's sake. But bronze oxen and wicker cages are comparatively inexpensive, and there were no courts handy in which damages could be recovered by the survivors. Locomotive engines and Pullman coaches are, however, rather costly receptacles in which to holocaust passengers. In spite of newspaper declamation, is it not self-evident that no railway-company gloats over the ruin caused by an accident upon its line?

To return to the five accidents above mentioned. In not one of them does it appear from the reports to the company — the newspaper accounts, or even the findings of the local coroner's jury (a class of valuable material which is not apt to be over complimentary to the railway-company) — that any of the mechanical agencies — operating-gear, engines, couplings, air-brakes, signals, wheels of the trains wrecked — were old, superannuated, or in bad repair; that the track was in bad condition; or that ordinary wear and tear had been allowed to remain unmet or exceeded. The utmost that can be said was, that, out of some three millions of men employed in the service of the railway-companies of the United States, five seem, for some utterly unaccountable reason, to have each failed in his duty of a moment, and that that moment in which he failed happened in the course of chance to be the supreme and crucial moment respectively in the lives of some two hundred human beings. It is too late in the day to call these failures, perhaps, 'Acts of God,' but what else are they? They are not the fault of the company. The company has no control over the minds of their servants. It could, indeed, negatively control their minds by so overworking them that nature refused longer to perform its functions. And for the safety of the community we think the law ought to take cognizance of a company which overworked its employees, and hold it to the same responsibility in that case as in cases where the company furnished dangerous conveyances to its patrons, or old, worn, and imperfect machinery to its servants. But in the five cases above selected there is no such allegation. The men sent out to warn an approaching train at Republic and at Kout's Station for once omitted their routine duty. The track-walker at Chatsworth forgot the bonfire kindled on the right of way. The bridge-inspector at White River and at Forest Hills failed to discover, or, discovering, to report, a flaw in a girder or a brace. To say that the companies failed to provide proper persons to perform these duties, is to say that they were willing to take the risk of losses running into millions rather than spend from five to a hundred dollars in cash. And most people who know any thing, know that (newspaper reporters and leader-writers, even, to the contrary) that is not the way railroads are managed in the United States, at all events. And we may add, that, had it been, the above enumerated accidents would not have waited until the year of grace 1887 to have transpired. The railroad-company, then, is at the mercy of its employees. I will not cite figures, because figures can be 'cooked.' But if anybody will sit down and compute the millions spent annu-

ally—not on public grounds, but for the purely selfish purpose of avoiding expensive accidents (that is, in self-preservation)—by the railways of the United States, in premiums for new inventions, in training-schools and shops for the education of its servants and the development of improvements, for the purchase of the latest devices for the saving of life and property, he will find his command of figures taxed to express the aggregate result. And if he will remember the number of courts and lawyers in this great country of ours, and the general gusto with which juries mulct railway-companies, he will not wonder, I think, that science cannot move fast enough in devising improvements to be utilized in the physical management of railways. The presumptive margin of profit in railway-operation is small enough as it is; but when the recurrence of such accidents as those at Republic, at White River, at Forest Hills, at Chatsworth, and at Kout's Station are admitted into the forecast, it is apt to produce a rather considerable shrinkage in the prospect, or in the temptation of stockholders to build more railroads.

Congress has lately established a bureau at Washington for the filing of railway-schedules, and for discovering what, if any, 'long hauls' and 'short hauls' can possibly be "under substantially similar circumstances and conditions." What public benefit this bureau may become to the public, it remains to be demonstrated. But, if the establishment of another bureau or commission to devise a means for supplying railway-companies with infallible employees were contemplated by the government, the government's good intentions, at least, could not well be questioned. Of the three millions of railway-employees in this nation, the percentage who do not do their duty is too microscopical for expression in decimals; but the railway-industry happens to be one in which an invisible percentage of carelessness produces enormously visible calamitous results; that is the price we pay for being carried back and forth to our business at five miles in ten minutes instead of five miles in an hour. But before the absolutely infallible employee is found, some eminent counsel of a railway-company may yet be bold enough to claim, that, since railroad-companies cannot take their brakemen and track-walkers from the class of the community which produces Sumners, Websters, and Conklings, the unknown mental processes which sometimes lead a brakeman or a track-walker, from causes entirely and subjectively mental, to happen to think of something else than his routine duty, ought to discharge a corporation which has no soul—if not from pecuniary damages for loss of life, limb, or property it has no agency in procuring, at least from newspaper declamation, and charges of sacrificing its passengers and patrons to mere 'greed.' Since, however we may explain it, it happens to be one of the most persistent of truths that accidents are of more frequent occurrence upon bankrupt or non-dividend paying than upon solvent and dividend paying railroads, one might say, logically speaking, that the 'greed' of a railway-company was a public security rather than a danger.

There is an apparent moral to be drawn from these records of casualty, which, from one point of view, perhaps, is safe enough. We may say, and say with great truth, that no achievement of applied science can be substituted for human watchfulness and care, but only for human skill. But to this there would be exceptions. The automatic hay-press, which rams and packs and binds not only, but debouches the completed ball in time to pack another in the place from which that ball is debouched; the Hoe printing-press, which counts the sheets it prints; and hundreds of others,—are watchfulness personified (and I am told that there are mechanics employed in the most delicate processes of watch-making which are said even to correct a chance misplacement of the material to be worked upon); but, since the operation of none of these is occupied with the transportation of human beings, should these automata fail, no lives are lost, and no public outcry awakened. The better statement is, I think, that no machine can counteract human wilfulness or neglect. The machine can only do the share of work allotted it. If the man fails in his, no accuracy of invention can suffice. A dial may register the failure of a watchman to visit a certain point so many times a night, and tell its unalterable tale in the morning. But, where a train of human freight rushes on to death and disaster, death and disaster tell the tale, upon the instant of the dereliction, and when it is too late to correct the fault or supply the omission. And the public scarifies with its denuncia-

tion the owners of the machine, and not the man or men who ought to have cleared its track but did not.

Everybody must trust somebody, corporations must trust everybody they employ: nay, more, the railway-company must not only trust everybody, but it is at the mercy of every track-walker on its line; and, worse than that, every passenger that a railway transports, every pound of freight it moves, is at his mercy too. Should that track-walker's eye be turned from an obstruction or overlook a detail, the eternal vigilance of every other servant of the company is worse than useless. The crash must come, and all the sooner because the machinery which moves the train is of the latest and best, and the coaches the completest and most luxurious, that human ingenuity has devised. Penalties, threats, the prospect of rewards, alike fail to make the man do his duty, or to prevent his forgetfulness or wilful absence of mind or body at a crucial point, or the intellectual hiatus of a moment which causes his hand to forget once in a half a million of times the required act which it is quite his second nature to do at all the other times. What is it? Is it an 'Act of God?' Is it inevitable necessity, or is it Nemesis?

The physical perils of the sea appear to have been already overcome. But the peril of panic remains, that no human ingenuity can prevent, and no human discipline, however it may foresee, control. The wheelsman of the 'Ville de Havre' had watched a vessel steering towards them for hours in a clear night; but when that vessel was about to crush the great steamer, the very thought of the monumental magnitude of the approaching peril paralyzed that wheelsman's brain, and the brain-paralysis steeled his hand, and he could not turn his wheel the few points that meant safety to a priceless human freight. What is there to provide against here? Shall we still preserve the antique phrase 'Act of God,' or merely say that it is fate or luck? Call it what we will, there is yet, it would seem, an element in all mundane affairs for which nothing human can invent an antidote or remedy, and which possibly should relieve us, under our human laws, of the responsibility. Whether or not mere human framers of human laws ever devise a statute for the emergency, of one thing, however, we can, I think, be sure enough; namely, if a relief from this 'Act of God' should ever come, it will be because science, and not the reporters, nor yet the leader-writers of our daily newspapers, have grappled with the problem. Every thing except the human brain, the human brain appears to have conquered or to be in a fair way to conquer. But to go outside of itself to control itself—that, it seems, so far, to have been unable to do.

APPLETON MORGAN.

SOUND-BLINDNESS.

THE phenomena of color-blindness are well known, and have been carefully investigated. We know that some persons can see to great distances, discern minute objects, enjoy works of art, and yet are unable to distinguish certain colors. Physiologists, and especially psychologists, have also found that there is a similar series of phenomena to be observed in connection with the sense of hearing. If a word were coined to describe these phenomena, it would naturally be 'sound-deafness,' but many who have written on this subject seem to prefer the term 'sound-blindness.'

A writer in the *London Journal of Education* uses the term 'sound-blindness,' and seems to have come to the subject from a pedagogic standpoint. He states that the difficulties which some persons have in learning to spell and in learning how to pronounce foreign languages suggested to him the possibility of the existence of such a thing as sound-blindness,—an inability to distinguish particular shades of sound, arising from some organic defect in the ear which is distinct from deafness, as that term is commonly understood.

The writer in question noticed that a small boy, in writing down a line of poetry which he had learned by heart, had spelled the word 'very' 'voght.' When some experiments were tried, it was found that the boy could hear no difference between 'very,' 'perry,' and 'polly,' and yet he was not deaf. The boy in question had great difficulty in learning to read, and, on inquiry being made, many teachers were found who testified to the fact that it is quite a common thing to meet with children who are very slow in learning to read precisely, because sounds, different to the teacher, were not different to them. It was also found, that, when a class of

boys reads aloud, some of them often give, instead of a word, its synonyme, though the latter be quite different in sound from the former. "The boys who were most apt to do this were the boys whose power of hearing was already under suspicion; and I inferred that they associated the printed letters, not with their sound, but with the concrete thing which they represented, much as if they had been a picture."

Another interesting observation is that of a boy of eleven years of age, who is a bad speller, and, when writing from dictation, makes mistakes in words which have an *r* or an *l* in them. He cannot pronounce those letters; but his failure is believed to be the result of a defect of ear, though he is by no means deaf, quite as much as the result of a defect of tongue or palate. Some of his misspellings are 'sunderelents' for 'sundry rents,' 'compreated' for 'complicated,' 'laserlacions' for 'lacerations.'

The writer points out that a want of power to distinguish vowel-sounds is quite as likely to be the cause of bad spelling in common words as carelessness amounting to *malice prepense*, or a weakness in the machinery which connects the movements of the hand with the orders of the ear. He continues, "We might have expected, that, on the analogy of color-blindness, vowel-sounds would be more likely to be confused than consonant-sounds. So far as my present experiments have gone, I infer that the inability to distinguish consonants is as common as a want of discrimination between vowels."

"The confusion caused by explosive consonants is, however, more remarkable than that from vowels; the inexperienced ear which is dull at catching consonants is capable of any distortion of sounds. To illustrate this, an experiment was tried with a class of eleven boys, averaging ten and a half years of age, and all able to read fluently, one or two of them being somewhat extensive readers. Some short ordinary words were selected, which nearly all got right, and then words specially to test the power of hearing, some of which, it was hoped, the subjects of the experiment had never heard before. Here are the variations of five words (the italicized vowels show interchange in the hard-vowel scale):—

	different capable	ultramarine	spectroscope	Epaminondas
1.	dirfreant capbul	ultramean	spaccrow	apnonas
2.	different	ultramarine	specourouscope	aparmondas
3.	diferent capeperbul	altrmerine	speckshow	aponedondas
4.	diferrent capperble	altrmererein	speckros-cop	achappynomeen
5.	diferant cameble	oltremere	spkerrope	appanandex
6.	drifrent capable	untummerrein	specteroskop	eupameondeous
7.	diffrent capabybely	ultriean	spesptroscope	emeandass
8.	drifent capebible	ultrern	spectuscope	epermondes
9.	diferent capebale	ultrmeriem	specktrocope	aporymondas
10.	differant ackable	ultomarien	spreting	apanenondes
11.	differint caperble	ultrumeree	spatroscope	appongamanges

"The room was a small one, and the words slowly pronounced twice, each word being written immediately after it had been read out. The majority of these boys are unusually intelligent. The worst speller but one recited, soon after his eighth birthday, 'The Battle of the Lake Regillus.'

"Twenty words in all were read out. Among them were 'yellow,' which all got right; 'instance,' five right, one of the best readers giving 'insentsess'; 'aniline,' of which there appeared these variations, 'haniyne,' 'anileling,' 'anelile,' 'animiene,' 'aleline,' the rest being at any rate phonetically correct.

"In the majority of these misspellings we at once detect want of experience in the use of the arbitrary connection between signs and sounds, and feel confident of improvement in course of time; but when we find a particular phonetic mistake frequently recurring, such as the substitution of *l* for *n* in 'aniline,' we suspect some defect either in the writer or dictator; and if the possibility of mispronunciation in the reader is eliminated, then we have to look for defect of ear or hand, or both, in the writer. Supposing that in correcting the misspellings we find that one or two subjects cannot recognize a word after the correct spelling has been shown them, while others have no difficulty, we must conclude that the ear is at fault, in the one or two; and if we find that the same individuals can recognize some sounds and not others, then the phenomenon of sound-blindness is established, and we have a satisfactory reason for the fact that some persons seem to spell natu-

rally, while others never learn; as, indeed, how should a man learn to spell even phonetically to whom not only the printed sign, but also the distinction of sounds, is arbitrary and conventional? and how should he not learn whose ear is a torturing conscience? Sound-blindness will account for dialectic variations. The ear being, as physiologists tell us, an even more delicate and complex structure than the eye, we can understand that the physical conditions of certain localities may produce insensibility to particular variations of sound. Perhaps the interminable rattle of London may account for the awful vowel-system of commercial men in the metropolis."

ETHNOLOGY.

American Languages.

IN the Proceedings of the Canadian Institute, Toronto, October, 1887, Mr. A. F. Chamberlain discusses the relation of American and Asiatic languages in connection with the question of the origin of the Indians. The concluding remarks of his article are so judicious that we wish to repeat them here: "The case for the eastern Asiatic origin of the American peoples rests too much upon apparent phonetic resemblances. Before any (phonetic) law like that of Grimm can be discovered and demonstrated between the American and related linguistic families, a thorough understanding of the relations which exist between the individual members of each branch of the American stock is requisite and of paramount importance." But we believe that an application of such principles to Chamberlain's own remarks will show that they are not well founded.

The author first discusses the Eskimo dialects, and gives a brief comparative vocabulary of different tribes in order to show their similarity. The words contained in this table are not taken from the best originals, and, besides, words of different meaning are compared. What the author considers as differences of dialect must in many cases be ascribed to a difference of the grammatical forms, or to the nationality of the collector. As his material is of so little value, the comparative Eskimo-Turanian vocabulary cannot be considered a good proof for his opinion that the American and Turanian languages have a common origin. We cannot consider the similarities of sound between the two groups other than fortuitous. There is another point of view in the paper which we cannot accept. Chamberlain uses the migration legends as a proof of earliest migrations. To a certain extent this may be right, but it is well known, that, if a tribe changes its seat, its legends are attached to new localities, and for this reason no conclusion on the migrations in a very remote period can be made from such facts. The migration of legends among aboriginal tribes is a problem of great difficulty, and one in which rash conclusions ought not to be made. The study of European folk-lore has shown that the origin of legends and their migrations are often wonderful, and that the most painstaking care must be taken in dealing with this subject. These considerations prevent us from accepting Chamberlain's theories as superior to those propounded by other authors. Our knowledge of American and North Asiatic ethnology and philology has not yet arrived at that stage in which we can deal satisfactorily with the question discussed by Chamberlain.

ETHNOGRAPHICAL MUSEUMS.—Dr. Kristian Bahnson publishes an interesting account of his thorough study of the principal European ethnographical museums ('Ethnografiske Museer i Udlandet,' in *Aarbøger for nord. Oldk. og Historie*). His concluding remarks are of particular interest, as they refer to the much-discussed question of museum arrangement. He shows that the arrangement according to objects has gradually been abandoned by all museums, and that the ethnological method, i.e., the arrangement according to tribes, has been adopted in its stead. He says about the former, the sociological plan, "The plan as a whole is absolutely wrong, in the first place, because those groups which ought to be the principal divisions in an ethnological museum, are made subdivisions. The ethnic individuality, which is a whole, is decomposed into a great number of elements. By an arrangement according to the character and purpose, the objects are taken out of their natural place, and they want the environment, which alone can explain their real meaning. In each stage of civilization there is a deep connection between the several ethnological peculiarities

of a people. Although this connection is not that 'harmony' from which conclusions have been made from the development in one region upon a similar development in another, it exists, influenced by numerous conditions, — climate, nature of the land, mental development, intercourse with adjacent countries, etc., — and it is necessary to convey the idea of such a connection in a museum, the object of which is to throw light upon the origin of a certain stage of civilization. Groups of objects, severed from their ethnic environment, may be valuable for the study of industry and technology, but an ethnographical museum cannot be arranged in this way, as objects belonging together from an ethnographical point of view are separated, while others of entirely different origin are united in one group. The other system of arranging museums is the ethnographical one. The system according to which all objects belonging to one tribe are placed together, and the single tribes are joined to ethnic groups according to their affinity, is so simple and natural in itself, that it has been generally accepted. It is a long time since ethnologists have ceased to invent more or less valueless systems of mankind which played an important part in the early history of ethnography. The attempt is being made to construct, by the use of strict inductive methods, the science of ethnology on the foundation of careful researches on single tribes and nations; and not until this has been done will problems of the mutual relation of tribes be taken up. In this way the foundation is laid for researches on the history of civilization. There is no lack of theories on the material and intellectual development of man, on the progress and decline of primitive nations; but here, also, the only way to reach satisfactory results is the inductive method; here also, a vast number of researches is necessary, before it is possible to gain that general point of view which is the ultimate aim of ethnology. In consideration of these facts, the ethnological arrangement is the only one fit for a museum. It does not give a solution of great problems, it does not give results of doubtful value, but it gives, what must be asked by the descriptive treatment of ethnography, the material arranged in such a way that it may be as easily accessible to students as possible. It is only in this way that the museum is able to illustrate the different states of civilization which occur in a single tribe, and, as the principal groups of nations are kept together, it shows the peculiar development in each group. All museums of any importance have adopted the ethnographic principle in laying out their plans, but not all have been equally successful in carrying their plans out. There are collections in which incidental arrangements disturb the general plan, and they show that the utmost consistency in adhering to the plan is necessary, else the museum will become a mere store-room." Dr. Bahnson further says, that, in carrying out such a plan in a large museum, the ethnological collections of each tribe must be subdivided according to sociological principles. These statements and views of the author are of great weight, as they are based on the study of a great number of collections and of a vast material. He shows plainly that there is no foundation to the alleged impossibility of arranging ethnological collections on an ethnological plan, and his idea that such a museum is the only one that can serve for the study of the history of civilization is undoubtedly correct.

THE BASQUES. — Chamberlain's view in regard to the connection between the Basques and Americans is in part founded on the alleged similar character of their languages. Many grammatical forms of the Basque consist of a combination of mutilated elements, and it was believed that this process was similar to the synthesis of American languages. Recent researches do not confirm this view. W. J. van Eys, one of the most learned Basque scholars, considers such combinations or contractions as similar to those occurring frequently in the vulgar dialects of Romanic and Teutonic languages. He mentions the Dutch *hy't'm*, which stands for *hebt gy het hem*. Our 'ain't ye' for 'are you not,' and others, belong to the same class. He ascribes the occurrence of such contractions in literary Basque to the late date at which the literature of this people developed. Gerland, who gives a very clear sketch of the Basque language and its relation to the ancient Iberian in 'Gröber's Grundriss der romanischen Philologie,' expresses the same opinion, and thus far-reaching conclusions on the connection between Americans and Basques must fall to the ground.

HEALTH MATTERS.

Cholera and Cold Weather.

IN a recent editorial in the *New York Medical Record* the statement was made that "cholera is always stopped by cold weather, and an epidemic here now would be impossible." In a letter to the editor of that journal, Dr. Reginald H. Sayre of New York takes exception to the statement, and quotes a number of instances to show that cholera is one of those scourges whose march is not stopped by heat or cold, high or low altitude, dryness or dampness, or any other condition of the weather. He says, —

"In 1830 the cholera appeared in Moscow in the month of October, and continued its ravages until the end of December, in spite of the severities of a Russian winter, and caused the death of 8,130 persons out of a population of 250,000, or about 1 in 30. From Moscow it went north to Yarasy, thence to Rybinsk, sixty leagues north of Moscow, where it appeared on March 19, 1831, in spite of the ice and snow which covered the ground.

"In October, 1831, the cholera appeared in Great Britain, and continued there until March, 1832, doing most of its destruction in December. About one-third of the people affected died.

"On the 27th of March, 1832, the disease appeared in Paris, and the mortality was so frightful that 861 people died in ten days.

"In 1848 the emigrant ship 'New York' left Havre on the 9th of November, having no sickness on board, and no cholera being then in Havre. During the voyage the weather became bitterly cold. There were some German emigrants on board, from a town where cholera had prevailed, who had a trunk which had belonged to a man who had died of cholera. They opened the trunk, took out the clothing, and wore it. On Nov. 22 a child died of cholera, and seven persons in all succumbed to it before reaching New York harbor. They were strictly quarantined, and the disease limited to those who died on Staten Island in the quarantine.

"About this same time another vessel from Havre, bound for New Orleans, developed the cholera on the twenty-seventh day out, and, owing to imperfect quarantine regulations, the disease spread rapidly through the town soon after the arrival of the vessel, there being then no other cases in the United States except those in the quarantine on Staten Island. From New Orleans the disease travelled to Memphis, appearing there toward the end of December, and at St. Louis in the first week of January, 1849. Toward March several places in the Upper Mississippi valley were affected, and then gradually the disease moved east through Chicago, which it reached in May, to New York, which became infected then, *and not till then*, although the disease had been imported to the city six months previously, but had not been allowed to land; and the city in this way kept free from infection until the cholera effected a flank movement, by way of New Orleans, and attacked her in the rear, having made its progress in spite of the winter, and having attacked the cities through which it passed in the cold weather.

"These facts in regard to the prevalence of cholera in spite of cold, and the well-known futility of a quarantine on land, make any attempt to lull the medical profession into a false sense of security fraught with great danger to the country, and I have therefore wished to call attention to the fact that cholera is *not* stopped by cold, and that to be quarantined effectively it must be arrested in our ports, which can only be done by having a general quarantine under the direction of the Federal Government."

In answer to this, the editor of the *Record* says that cholera has never prevailed in New York City in the winter-time, and rarely in any northern latitude save under very peculiar and exceptional circumstances. In support of this view, he quotes from Ernst's 'Reference Handbook of the Medical Sciences,' which states that "the progress of an epidemic is invariably arrested by cold, the winter season having always stopped those of which we have any record." He further says that cholera has frequently been imported into warm New Orleans in the winter-time, notably in 1873, when it commenced in February. But it did not winter over that year, or notably any other year. But constant importations into New Orleans almost every month of the year during the California gold-fever times sent much cholera to St. Louis and Chicago, and other Western places, almost every month in the year; so that it seemed to winter over, but, in fact, was kept alive by almost incessant new importations. The effect of cold on the further spread of cholera,

and upon the vitality of its germs, is a matter of deep moment at the present time, and we shall be glad to receive any information from our readers which will throw light upon the subject.

SEWER-GAS.—In an editorial on the subject of the air of sewers, the *New York Medical Journal* refers to the fact that some authorities do not regard sewer-air as of itself usually deleterious, while others attribute to it cases of sickness which have from time to time been reported, and asks how this apparent discrepancy is to be accounted for. Sewer-air is regarded by some sanitarians as dangerous only when it contains the germs of specific diseases; but the many instances in which it has seemed to be the sole cause of persistent sore throats, headaches, and diarrhoeal troubles without the development of any well-defined disease would seem to militate against this view. Dr. Playfair reports a case in the *Lancet* in which serious symptoms were developed in a puerperal woman, which were undoubtedly due to exposure to foul air from the house-drains. In the Proceedings of the Royal Society is a paper on this subject by Professor Carnelly and J. S. Haldane, M.B., in which it is shown that the air of large and well-ventilated sewers is comparatively free from noxious gases, and contains proportionately fewer micro-organisms than the outer air of the same locality. These observers also found that most of the micro-organisms found in the sewer-air were drawn in from the outer air, and not developed in the sewer; that micro-organisms tend to settle instead of remaining in the air; and that, when bubbles of sewage burst, a number of micro-organisms are set free into the air. The editor of the *New York Medical Journal* states that it has been noticed that illness traced to defective drainage is more frequent in houses where there are holes in the pipes, open joints, or unused fixtures, than where there is simply an absence of traps under fixtures in constant use. Holes in vertical or branch pipes, and open joints, will often be found covered about the edge with slime deposited from fluids that have spurted through the holes during their passage. The outer border of this deposit is often dry and crumbling, and from that point to the edge of the opening will be found all degrees of moisture. He asks whether it may not be that such deposits around holes and lining dry unused pipes are the real breeding-places of the micro-organisms believed to be productive of so much sickness in houses, every outward current of air passing into the room being loaded with them. He calls attention to what is undoubtedly the fact, that pathogenic micro-organisms may produce their injurious results by being swallowed, as well as inhaled, and that the immunity of sewer-men, scavengers, and plumbers may be due to tobacco-chewing, and the ejection of the buccal fluids instead of their deglutition. The value of bacteriological science was well illustrated recently in the recognition of the cholera microbe, the comma bacillus or cholera spirillum, in cultures obtained from the excreta of cases at the quarantine of New York, which were suspected to be cholera. Such cultures were made by Drs. Biggs, Prudden, Kinyoun, Armstrong, and Weeks, and the microbe was discovered by each one of these investigators, thus determining absolutely the nature of the disease. In a paper on the diagnostic value of the cholera spirillum, read before the Society of Bellevue Hospital Alumni, Dr. Biggs gives a history of his experiments, and states that this is, he believes, the first case in this country where a diagnosis of Asiatic cholera has been based upon biological examinations.

HEALTH OF SCHOOL-CHILDREN.—The following recommendations have been made by the State Board of Health of New York, and will doubtless be brought before the Legislature at its next session: I. That its organic law be so amended as to authorize its executive officer, where an emergency arises and the local board of health of the town or village in which the emergency occurs has not organized and appointed a health-officer, to appoint a physician as acting health-officer at the expense of the town or village concerned, who shall, until such time as a board of health for said place has been organized, as provided for in Chapter 270, Laws of 1885, have and exercise, under the direction of the secretary of the State Board of Health, all the powers and duties of a board of health regularly appointed. II. That the following requirements be embodied in a law as essential to the sanitary welfare of the school-children of the State: (a) Building should rest on a good dry founda-

tion, and be constructed to insure the comfort of children during inclement weather; (b) Class-rooms should be arranged so as to admit light from left side and back of pupils, and the area of windows should be one-fourth of floor-space; (c) Not less than 250 cubic feet of air-space should be allowed per pupil, and provision for changing air should be made, so as to secure each pupil not less than thirty cubic feet of fresh air per minute; (d) The temperature of the school-rooms should in winter be maintained at a range not to exceed from 68° F. to 70° F.; (e) Closets should be provided for each sex, entirely separate from each other, and having entirely separate means of access; when situated outside the building, they should be about fifty feet distant, and should be connected with it by a covered walk; privy-vaults should be utterly abolished; movable boxes or buckets should be placed under the seats, and earth or ashes provided as a deodorant; buckets should be cleaned out at least once a week; (f) In addition to his other powers over schools, the superintendent of public instruction should have authority to oblige school-trustees to make improvements or repairs in school-buildings for sanitary purposes, whenever the local board of health considers such necessary, and their judgment is supported by that of the State Board of Health.

YELLOW-FEVER AT TAMPA.—During the week ending Nov. 2, there were at Tampa, Fla., 74 cases of yellow-fever, with 9 deaths. The total number of cases during the epidemic is approximately 325, of which 48 have proved fatal. On the 3d instant there were three new cases and 2 deaths. The quarantine inspector or telegraphs that he thinks the epidemic is rapidly subsiding. Two cases, one of which died, occurred three weeks ago at Many Lakes, Fla., but there has been no spread of the disease. At Manatee, having a population of 300, it is reported that there are 16 cases of yellow-fever, and that there have been 3 deaths from that disease.

OLD OBSERVATIONS ON HYDROPHOBIA.—In a letter to the *Boston Medical and Surgical Journal*, Dr. Goodale of the Botanic Garden of Harvard University says, "In the course of my reading, I have chanced upon the following passage, which may prove of some interest to your readers. It is taken from 'Observations on Hydrophobia,' by James Thacher, M.D., Plymouth, Mass., 1812. It seems as if Dr. Thacher's project was in a fair way of being carried into successful execution, after a lapse of more than seventy years. From p. 300 of the work cited above, the Italics standing as in the original: 'Experiments made upon the canine poison in brutes, might be considered as an arduous and hazardous undertaking, but it is not to be deemed altogether impracticable and I will suggest the following project for the purpose. In the first place, dogs when affected with madness, instead of being killed, should be confined and secured that the disease may run its course, and for the ascertainment of many useful facts connected with its several stages. If experiments on dogs should be deemed too hazardous, let other animals of little value be selected, provided a sufficient number can be procured. Having provided for their security in some proper enclosure, let them be inoculated with the saliva of the mad dog, by the point of the lancet, which would undoubtedly prove as effectual as the dog's teeth. The animals thus infected, are to be the subjects of various experiments and the most attentive observation. With some, the inoculated part might be cut out at different stages, to ascertain the latest period in which it may be done successfully. To others, various counter-poisons and specific remedies might be applied to the wound and administered internally. In fact, it would be difficult to determine, *à priori*, the extent of the advantages of this novel plan, if judiciously conducted. You may smile at my project, but however chimerical and visionary it may appear, I would rejoice to be the *Jenner* of the proposed institution; though I might fail in realizing my thousands, I could pride myself in being the candidate for the honor, and the author of an attempt to mitigate the horrors attending one of the greatest of all human calamities.'" It will be seen from this that Dr. Thacher anticipated Pasteur by many years.

In *Science* of last week, first column, 4th line from bottom, '1886' should read '1885'; same column, 6th line from bottom, '1885' should read '1886.'

BOOK-REVIEWS.

The American Journal of Psychology. Ed. by G. STANLEY HALL. Baltimore.

THE announcement made some months ago, that a journal devoted to the scientific aspects of psychology was to be published under the auspices of the Johns Hopkins University, excited considerable comment. Some seemed to think that we had philosophical journals in abundance, and whatever surplus energy America had in reserve in this direction might well be utilized in strengthening the journals of England and the continent; others doubted whether so small a department could really supply material enough to sustain even a quarterly periodical; while those who have not yet become acclimatized to the new atmosphere that is slowly but surely displacing the old, dogmatic, non-progressive, and lifeless treatment of psychological topics, intimated that they saw in the new-comer a further belittling of a noble study, and the harbinger of a much hated 'materialism.' The first number of the journal proves beyond a doubt, that, for a time at least, the material will not be wanting, and quite as certainly shows that the movement in favor of an experimental psychology is strong and important enough to merit a separate organ of publication. If we add to this the guaranty of sound scholarship and all-sided appreciativeness that the name of the editor (as also of the university from which it comes) affords, we seem justified in welcoming the journal as an ornament to American science, and as promising to mark an era in the development of one of the most significant movements of our age.

The two main purposes of the journal are to publish original studies, and to review the psychological literature. The first is represented by four articles, all worked out upon an experimental basis; while the critiques and notices fill no less than seventy-eight finely (perhaps too finely) printed pages. The leading article is contributed by Dr. Warren P. Lombard, and describes a very remarkable series of experiments upon the variations in the extent of the 'knee-jerk' under various conditions of the nervous system. It is well known that if one leg is supported, and the knee partly flexed (most conveniently by crossing one leg over the other), a sudden blow upon the ligament just below the knee-pan will cause an involuntary and jerky movement of the foot. This apparently insignificant phenomenon became of special importance when it was observed that it was generally absent in a common form of spinal-cord affection known as *Tabes dorsalis*. The nature of the process is discussed in quite an extensive literature, and the two main opinions regard it as (1) a simple reflex act, with a direct course from the tendon to the lumbar cord and back to the muscle, and (2) as an act not reflex (because the time it takes is much too short), but rather as a mechanical effect under the influence of a reflex centre, — a 'tone' rendering the muscle more or less susceptible to such stimuli. In either case the variations in the extent of the movement are co-ordinated with the condition of the nervous centres, and thus become an index — and, as Dr. Lombard shows, an incredibly delicate index — of a very mysterious central process. Previous observers had shown that a violent contraction, such as clinching the hands, or even slighter movements, as well as strong sensory stimuli, just before the striking of the ligament, greatly increased the extent of the resulting movement. This was explained by supposing that the effect of the movement was to increase the irritability of the cord-centres (perhaps by removal of inhibitory influence from the brain), on whose integrity the knee-jerk depends. Dr. Lombard was able to secure more delicate results by substituting a blow from a hammer swinging through a definite arc, and striking with a constant force for the unequal movement of the hand, and the writing of the resulting movement of the foot on smoked paper instead of its rough estimation by the eye. The first result of this method was to show that the extent of successive knee-jerks produced by equal blows of the hammer was very different; and this, too, when the subject was lying perfectly at ease, and so avoided all re-enforcements by voluntary motion. On comparing these variations with those resulting from true re-enforcements, it was clear that they might be due to very slight changes in the individual; and, by taking the average of a score of movements, it was found that their extent varied quite constantly with the force of the blow.

Dr. Lombard then subjected himself for two weeks to a tedious routine of work, recording his knee-jerk under precise conditions at eight definite times of the day, and keeping a diary of his general condition, as well as recording the condition of the temperature, barometer, etc. In this way he accumulated the records of over six thousand observations, suggesting several interesting results. In brief, he shows that this index of the condition of the nervous system is sufficiently delicate to be regularly influenced by the time of day (it begins low, rises very much after breakfast, and then gradually sinks with several ups and downs); by the taking of a meal (notably rising after breakfast); by fatigue, either physical or mental (in both cases showing marked decrease); by the slightest movement (i.e., the re-enforcements by talking, swallowing, etc.) or attractive sensations of sound, light, etc.; by all kinds of mental excitement; by holding the breath (a very marked increase when held for a minute or so); by the state of the thermometer (in general diminishing as the temperature increases), as of the barometer (quite closely rising and falling with a rise and fall in the barometric column).

An adequate idea of the delicacy of these variations with different mental conditions can only be gained by a citation. "One day during the experiments a procession passed the end of the street, a short distance away, and the effect of the music was very evident. The twenty-five experiments of the examination which had just been made had shown the average knee-jerk to be 32 millimetres. At the approach of the procession, the subject resumed his place on the apparatus, but the first blow was not struck until the first band was passing the end of the street, — 60,¹ 71, 74, 70, 60, 55; another band immediately followed, and it began to play 'My Maryland' just before it reached the street, — 62, 76, 76, 74, 71, 66, 59, 64, 59; this was followed by a drum corps, — 48, 55, 51, 55, 53, 49, 52; and then the music died away in the distance, and only the ordinary street-sounds remained, — 40, 45, 37, 30, 39, 53, 37, 29." In short, not only does music re-enforce the knee-jerk, but the character of the music, especially its emotional power, determines the amount of such influence. That these results are not the result of an anticipation by a theory is shown very conclusively by the fact that on several occasions Dr. Lombard fell into a more or less deep sleep during the experiments, and, if the blow happened to come just after dreaming of an exciting event, the knee-jerk (very low by the inactive condition of the subject) showed a sudden rise. The phenomena are thus taken outside the conscious realm. It seems no illegitimate use of the imagination to picture the time when the inquiry after one's health will take the form of, "How is your knee-jerk?" or the poet describing the effect of anger will exclaim, "Truly, my knee-jerk arose."

The remaining articles — on dermal sensitiveness to gradual pressure-changes, by Prof. G. Stanley Hall and Yuzero Motora; on a method for the experimental determination of the horopter, by Christine Ladd-Franklin; and on the psychophysics law and star-magnitudes, by Dr. Joseph Jastrow — are of a more technical character; and this is a very laudable feature, for it serves not only to frighten off the many dilettanti of psychic research, but to justify the strictly scientific methods of psychology. Professor Hall and Mr. Motora describe a new method of experimentation, by which a weight pressing upon the finger is either gradually increased or gradually diminished, and the sensibility is measured by the time necessary for the subject to decide in which direction the change has been made. The problem is a very complex one, involving not only the amount of change, the rapidity of change, and the initial pressure, but also the 'confidence' of the subject. The interesting results reached are only preliminary, but foretell a hopeful future for this valuable new method. Mrs. Franklin describes a very striking illusion, consisting of the appearance of a third line at right angles to the plane of the paper, on which a pair of crossed lines, with their acute angle towards the observer, are viewed in a certain position relative to the eyes. These small upright phantom-lines are so distinct that they furnish a means of determining the shape of the horopter (i.e., the sum of the points which in a given position of the eyes will seem single), at least in its simpler forms. Dr. Jastrow utilizes the comparison of the photometrically measured illuminating powers of the stars (made by the Harvard Observatory)

¹ The numbers refer to the extent of the knee-jerk in millimetres

with the naked-eye estimation of their serial magnitudes, to find what is the relation between the two series; i.e., as the magnitudes increase by apparently equal intervals of brightness, how do the measured illuminating-powers increase? He finds, that, as the psychophysical law requires, the latter increase by a constant *ratio*, but that this ratio is not exactly constant, but decreases slightly (according to a formula given in the paper) with the brightness of the stars.

The critical portion of the journal will perhaps arouse more comment than the original part, because it comes more in conflict with current views on psychological topics. While not taking an aggressive tone, the policy of the journal is evidently to plainly and forcibly state the broader inferences upheld by a technical study of mental facts, and, if necessary, to fearlessly combat views opposed to or neglecting such considerations. The able detailed review of the work of the English Society for Psychic Research is sure to attract attention. The point of view is decidedly negative. The evidence in favor of 'telepathy' is regarded as entirely inconclusive by lack of a host of necessary precautions, as well as a consideration of other modes of explanation. It is an aspect of the question the importance of which will be more and more generally recognized as the first gust of enthusiasm excited by apparently wonderful results subsides. A review of the psychological text-books of Professors McCosh, Bowne, and Dewey is a destructive criticism of the standpoints from which these writers set out, while Professor Ladd's 'Physiological Psychology' receives very just proportions of praise and blame.

In addition to this, there is a review of the 'brain-localization' question by Dr. Starr, of Mr. Galton's views on the persistency of type by Professor Brooks, of Delage's researches on the functions of the semicircular canals by Professor Sewell, and a note on logical machines by Mr. C. S. Peirce, together with a large number of useful minor reviews and notes. An undue number of misprints disfigure some of the pages.

Greeko-Slavonic Literature. By M. GASTER. London, Trübner. 8°.

THE importance of researches on the growth of folk-lore is more and more recognized. While in the early times of this study the lore of each nation was considered as an outcome of its ancient mythology, later on the interdependence of the traditions of nations widely separated in space and time was more clearly understood, and researches on the origin and migration of legends became of greater importance. While this historical point of view is the leading one in the inquiries of most students, the psychological character of each nation as influencing its folk-lore must not be disregarded. The present volume treats of the connection between European folk-lore and the early literature of Slavonic nations. The author treats first of the influence of Bogomilism upon the religious literature which later on became folk-literature of the European nations. He traces the latter back to Greek texts which came to Constantinople from the east, and passed thence to the Bogomils. A second source, equally Oriental in its origin, was supplied by Jewish legends. He discusses the Apocrypha of the Old and New Testaments in its influence upon European literature, and shows in a few instances the interesting phenomena of their transition from tales into ballads, and from ballads into lyrics, in which the name of the hero disappears gradually, and a personal song is changed into a general impersonal one. The author finds in the belief of witchcraft in the Graal legend and other traditions, not those relics of hoary antiquity which they are generally considered, and as which they have become the object of a reconstructive mythology, but a result of the Christian legends and myths, which became the property of the people at a comparatively recent date. In discussing the origin of the romantic literature, Gaster favors the opinion that it was also introduced into Europe by the Slavonic nations, and rejects Benfey's theory that it was communicated to the western people by the Mongolians. In an appendix Gaster tries to solve the problem of the origin of the Glagolitic alphabet, and shows that a connection with the Armenian alphabet is at least probable. The whole volume is an extremely interesting study of the growth of folk-literature, and shows how intricate the channels are from which its sources flow. Great care must be taken in treat-

ing questions of this kind, particularly among nations which have no literature, where historical facts, upon which the study must be founded, are entirely wanting. Particularly in this case rash conclusions must not be made until we are better acquainted with the psychological laws of the growth of folk-lore. The historical method as applied by Gaster is the only one that can lead to satisfactory results, but it must be supplemented by an inquiry into the assimilation of legends by different nations and their blending with the more ancient stock of folk-lore. The latter point has been disregarded by the author, and therefore some of his conclusions on the Oriental origin of certain legends cannot be accepted until fuller proof is given.

An Elementary Treatise on Analytical Mechanics. By WILLIAM G. PECK. New York, Barnes. 12°.

THIS is, as its title implies, an elementary treatise on the subject named, and is of substantially the same character as the majority of works of similar purpose, intended for the introduction of the student into the study of analytical mechanics. Dr. Peck, however, has the advantage, as an author, of having had an unusually extended and very fortunate experience in teaching, and his book may be taken as the embodiment of so much of the subject as he has found the average college-man capable of taking up during the average college course of advanced mathematics. It is intended, as stated in the preface, to include all the principles needed by students in technical courses of study, and the calculus is used to a moderate extent in their development.

This work is by no means such a treatise as that of Bartlett, and is necessarily given a much more condensed and less logical form. It covers, however, the full range of work which the student can be ordinarily expected to take, and it may be made to pave the way most satisfactorily to the use of advanced treatises and the works on applied mechanics which are now studied in the best technical schools and schools of engineering. Its accuracy is vouched for by the reputation and experience of its author, and its plan may be seen by inspection to be good and satisfactorily complete. Kinetics and the doctrine of energy are given the place to which they are entitled, — a place denied them in books following the older writers on this subject. We should suggest that the discussion of the mechanics of gases and vapors might be enlarged profitably by the introduction of the pure thermodynamics of the subject, and that the last chapter, that on machines, might be improved by the revision of the descriptive matter, and by a study of modern examples of such apparatus. No criticism lies against this work especially; but it is time that all these elementary treatises on this subject were pruned of their antique illustrations, — the compound balance, for example, — and modern sketches substituted, such, for example, as Dr. Peck gives us in his article on the rotary-pump. On the whole, this book is one of the very best of its class; and the writer has found, by experience in its use, that it is a most excellent text-book.

NOTES AND NEWS.

THE account of the recent trial in England of the Spanish cruiser 'Reina Regente,' resulting in the development of a speed of 20.6 knots over a measured mile, has been received with keen interest at the Navy Department, where every effort has been made to design vessels of like high speed to meet the demands of Congress. The number of war-ships able to make above 19 knots is much smaller than is commonly supposed, and, in fact, the records of the department show that but two other vessels have been able to attain that speed. These are the 'Dogall,' built in England for the Italian Government, which made one run over a measured mile at the rate of 19.66 knots per hour; and the 'Orlando,' built by private contractors for the English Government, which made one run at the rate of 19.25 knots per hour. It is said at the department that these two vessels, together with the 'Reina Regente,' are the outcome of efforts to reach 19 knots, running through many years; and the small measure of success attained renders it unsafe to guarantee so high a speed for the cruisers now building, and known as the 19-knot cruisers.

— A complete list of the papers presented at the meeting of the National Academy of Sciences, held at Columbia College, New

York, recently, is as follows: 'Seismoscopes and Seismological Investigations,' T. C. Mendenhall; 'On the Primary Specializations of the True Fishes,' E. D. Cope; 'A Study of the Behavior of Metals under Variations of Temperature,' William A. Rogers; 'Chemism in its Relations to Temperature and Pressure,' T. Sterry Hunt; 'On the Mechanical Origin of the Structures of the Hard Parts of the *Mammalia*,' E. D. Cope; 'Progressive Series in Chemistry,' T. Sterry Hunt; 'Kilauea, a Basalt Volcano,' J. D. Dana; 'Circulation of the Sea through New York Harbor,' Henry Mitchell; 'On a Study of Color Contrast,' Ogden N. Rood; 'On the Relative Variability of Men and Women,' 'On a New Form of Reproduction in *Medusæ*,' and 'On the Lucayan Indians,' W. K. Brooks; 'Experiments in Measurements of Statical Electricity in Absolute Units,' and 'On Potential as measured by Work, a Mathematical Discussion,' A. M. Mayer; 'A Comparison of Antipodal Faunas,' Theo. Gill; 'On a Discovery Recently made in Connection with the Flight of Birds,' W. P. Trowbridge; 'On the Determination of Star Magnitudes by Photography,' E. C. Pickering; 'On the Constant of Aberration,' A. Hall; 'The Cretaceous Coals of Western North America,' and 'The Future of Gold and Silver Production,' J. S. Newberry; 'The Temperature of the Moon,' S. P. Langley; 'On a Method of Making the Wave-Length of Sodium Light the Absolute Standard of Length,' A. A. Michelson and E. W. Morley.

— The increase of interest in the sciences centring about a scientific education in England is well shown in the announcements of lectures to be given in connection with the Association for the Education of Women at Oxford. The three courses are, on mind, its conditions and functions, by Mr. W. L. Courtney; on the outlines of the history of education, by Mrs. Scott; and on elementary physiology, by Mr. Dixey.

— It is encouraging to see the appearance of new editions of books of acknowledged excellence. Macmillan's publishing-house has just prepared new editions of Lotze's 'Metaphysics' and of Sidgwick's 'Principles of Political Economy.' The latter contains some emendations and omissions from the text of the first edition, and the preface credits Schönberg with exerting an influence on the author's economic thought. The new edition of Lotze is in two volumes, handsomely gotten up, and offered at a very low price. We trust it will be widely read, for the *Spectator* only expressed the opinion of all philosophical workers when it said, "No man of letters, no specialist in science, no philosopher, no theologian, but would derive incalculable benefit from the thorough study of Lotze's system of philosophy."

— The Industrial Education Association is about to issue leaflets giving concise information on points of its work regarding which questions are continually asked. The first will be ready in a few days, and will state compactly what the argument for manual training is.

— Several of the commissioners of Chinese customs, in their reports for the past year, which have just reached this country, says the London *Times*, refer to the competition in the English market between teas from India and China. The commissioner at Hankow says that at that port for the year the fine teas bought for England have lost all around. "All tea-buyers say that Indian tea is the tea of the future for people who can afford to pay for a good article. There is no reliable market for choice China tea, Cheap tea—'beautiful two-shilling tea'—bought here to land at sixpence a pound, is what seems to be wanted. It can be sold at a price to suit any pocket, and can be made quite drinkable and given a body by the addition of a few pennyworths of good, full-flavored Indian." Similarly the commissioner at Foochow remarks that one feature of the tea trade of the year has been the neglect of teas over a shilling a pound in the London market almost throughout the season. This discourages the production of the finer kinds of tea in China. Year by year the competition of the Indian teas displaces the finer qualities of the China leaf, "in spite of which there are many of experience in the trade who maintain that if the old quality were again forthcoming from China she would soon recover the position she seems to be losing in the world's consumption of this article." In Shanghai the commissioner reports an increase in the export of tea, but says it is due to the improved

demand in England and Russia for low-grade teas, but the merchants have lost no medium and fine quality teas, the rates for them being unprecedentedly low. "This depreciation in their value in England is partly assignable to a falling-off in the Russian demand for fine tea; but the want of keeping properties in China leaf, probably owing to hasty and imperfect preparation, has also a good deal to do with it." Fine China teas have not been bought for Russia because of an increase in the import duty, and, in place of increasing the price to the retail purchaser, an inferior leaf has been purchased."

— The German Academical Union, in its last general meeting at Berlin, laid down the following principles of reform for the German schools: (1) The children are in many ways overburdened by the present scholastic system; (2) There is not sufficient harmony between the school and the home life; (3) The training of the body is not attended to in proportion to that of the mind; (4) The exclusive privileges belonging at present to the classical schools, as securing an entrance to the learned professions, ought to be extended to the modern schools; (5) There ought to be an easy access from the elementary schools to the middle and higher schools; (6) The *Einheitsschule* is the most pressing need of the present time.

— The forty-third annual meeting of the Massachusetts Teachers' Association will be held in the Girls' High-School building, Boston, Friday and Saturday, Nov. 25 and 26. The following programme is published:—Nov. 25, 'English in Secondary Schools,' by William R. Shipman, D.D., professor of rhetoric, Tufts College, discussion to be opened by W. C. Collar, head master of Roxbury Latin School; 'What the Public demands from the Public Schools,' by N. A. Calkins, superintendent of schools, New York City; 'The Care of Children,' by Henry C. Haddon, master of the Shurtleff School, Boston; 'The Care of Our Younger School-Children,' by Ann E. Newell, Alger Primary School, Boston; 'Can the Principles of Civil Government be taught in Schools?' by Albert Bushnell Hart, Ph.D., instructor in history, Harvard University, discussion to be opened by Ray Greene Huling, principal of the High School, New Bedford; 'Some Notes on Secondary Schools in Europe,' by George A. Bacon, Ph.D., editor of *The Academy*, Syracuse, N.Y.; 'Arithmetic in the Grammar School,' by Francis A. Walker, Ph.D., LL.D., president of the Massachusetts Institute of Technology, discussion; 'Modifications needed in the Grammar-School Curriculum,' by A. P. Stone, LL.D., superintendent of schools, Springfield, discussion; 'Language,' by George I. Aldrich, superintendent of schools, Quincy, discussion to be opened by Larkin Dunton, LL.D., head master of the Normal School, Boston; 'Sight-Reading,' by Mary I. Lovejoy, principal of the Broadway School, Chelsea, to be followed by class exercises, illustrating progressive stages in the first, second, and third years, discussion to be opened by William T. Harris, LL.D., Concord. Nov. 26, 'Report of the Committee on Necrology,' by Nathaniel T. Allen, chairman; 'Grammar-School Education' (report of the Committee on Educational Progress), by Ray Greene Huling, chairman; 'Character as an Object of School-Education,' by Louisa P. Hopkins, supervisor of schools, Boston, discussion to be opened by Robert Swan, master of the Winthrop School, Boston; 'How to secure the Better Preparation of Teachers,' by Ellen Hyde, principal of the State Normal School, Framingham, discussion to be opened by A. G. Boyden, principal of the State Normal School, Bridgewater.

LETTERS TO THE EDITOR.

. The attention of scientific men is called to the advantages of the correspondence columns of *SCIENCE* for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Amnesia.

IT seems to me that cases of amnesia like those mentioned in *Science* for Nov. 11 are not very rare; certainly three such cases have fallen under my own observation within the last twenty years.

One was of a lady who suffered from violent puerperal convulsions, followed by fever, which rendered her practically unconscious for ten days. After her recovery she found that she had lost entirely the recollection of every thing that happened during the week before her sickness.

In another case two gentlemen of my acquaintance, while driving across a railroad, were struck by the engine. One of them was instantly killed: the other was so seriously injured that he was unconscious for twenty-four hours, and for several weeks lay at the point of death; after his recovery he never regained the recollection of going to drive on that fatal morning.

In another instance a gentleman well known to me was thrown from his carriage by a runaway horse and by collision with another team. He was rendered insensible for fifteen or twenty minutes, and after regaining consciousness, although he remembered his horse running away with him, he never had any recollection of the collision or of falling.

In each of these cases there seems to have been some relation between the length of the period of unconsciousness after the sickness or accident, and the memory-blank before it.

JOSEPH HALL.

Hartford, Conn., Nov. 12.

Changes in Indian Languages.

THAT unwritten languages might change more rapidly than those which are preserved in books is very evident, though the verses of Chaucer and Spenser would puzzle the modern school-boy. Yet the vocabulary of an unlettered people has elements of stability in its comparatively few words, and often in the songs and ceremonies preserved through many generations. How rapidly they may change is not so easily proved, for this requires accurate vocabularies made long ago, which must be carefully compared with a language at a recent period. A moderate basis may be found for such a comparison in the case of some of the New York Iroquois, who early attracted the attention of learned men, and from this may be drawn a few suggestions.

I make this comparison now, in the case of the Mohawks, between Father Bruyas' lexicon, written about A.D. 1700; the 'Mohawk Prayer-Book' of 1769; and Schoolcraft's 'Notes on the Iroquois,' written in 1845. The later prayer-book of Rev. Eleazar Williams might also be cited, as the work of an educated man brought up as a Mohawk; but its marked differences from all other books printed in that language would require a good deal of comment. Father Bruyas' lexicon is of radical words, and deals with phrases and verbs much more than with nouns and adjectives; yet I make the comparison on the latter. In a little over one hundred words common to both Schoolcraft and the missionary, fifty-one differ almost entirely, while fifty-eight are either alike, or so nearly so as to have the resemblance apparent. Perhaps half of the latter number are modified forms of the same words. These represent the changes of an existing Indian language in about a century and a half, so far as they may be called changes. About one fourth are the same as they were in A.D. 1700; another fourth are partially changed; nearly one-half differ entirely.

It is to be remembered in this, that, in a language whose words are often descriptive, several words might represent the same object, and often do so, while a writer may choose but one of these. Many synonymes appear in Bruyas' vocabulary and in the 'Mohawk Prayer-Book.' One of these words, once common, might disappear and be succeeded by another, not new, but for a time obscure. In Schoolcraft's vocabulary each English word has a single Mohawk word as its equivalent. There may have been many others which do not appear.

The 'Mohawk Prayer-Book' of 1769 was the work of several hands, and has comparatively few of the words found elsewhere. I have not made a close comparison, but have noted twenty-five names agreeing with Bruyas, and thirty with Schoolcraft, while it has very many given by neither. It is hard to catch or represent the Iroquois inflection, and so spelling has made a difference where the word is clearly the same, though possibly changed. Thus 'ice' was rendered *Gawisa* in 1700, *Owiese* in 1769, and *Orise* in 1845, the latter perhaps approaching our own word. Some words which

I have classed as similar are much farther apart than these, often differing greatly.

As this paper is only suggestive, I note some changes in the Onondaga language, based on a comparison of Zeisberger's dictionary, made subsequent to 1750, and Schoolcraft's vocabulary of 1845. In comparing nouns and adjectives common to both, out of one hundred and fifty, I find eighty-six entirely or widely different, and sixty-four the same or plainly similar. In regard to the nature of these changes, the same remarks apply as to the Mohawk. Relatively the latter might be called a written language, and had changed much less in a century and a half than the Onondaga had in less than a century. In a sense the latter might seem almost a new language. Many words in it, of course, are new, as those of animals and articles of which their fathers knew nothing, and doubtless others were assumed for familiar things when some one hit on a new characteristic. The word for 'hog' is expressive of its voice, and is better rendered by Zeisberger as *Kweas kweas* than by the modern *Quis quis*. *Gil gil* does very well for a hen, and others as good might be cited. The Oneidas and Onondagas formed different names for the elephant, yet easily understood by both; the one calling it 'that great naked animal,' and the other terming it the 'long nose.' The Onondaga name for the black raspberry is descriptive, 'the plant that bends over,' and many are quite as picturesque. This shows how a vivid imagination could readily multiply or change names among a primitive people, and how verbs might persist long after nouns had vanished. Place such a people by themselves, amid new scenes, and how quickly their speech might alter! The Onondagas have not moved over twenty miles in two hundred and fifty years, yet how much their tongue has changed in less than half that time! A migration to new and distant homes would have produced many new words, and then the language would have remained much the same for a time, waiting for other disturbing causes.

W. M. BEAUCHAMP, D.D.

Baldwinsville, N.Y., Nov. 11.

Distillery-Milk.

AFTER the grain is mashed (corn comprises three-quarters of the grain used), it is cooled and run into the fermenting-tubs, where the yeast is added. The period of fermentation is seventy-two hours the first three days in the week, and ninety-six hours the last four days, which include Sunday; this length of time being considered by the government sufficient to ferment all of the saccharine. It is during this period that the acetic acid is formed, unless very great care is taken. It does not necessarily follow that acetic acid appears but acetic fermentation occurs more often than otherwise.

At the expiration of the fermenting period, the 'beer' (the entire mass in fermentation) is run through the 'still' at a temperature supposed to evaporate all the alcohol and fusel-oil; which vapor is run into a worm from the top of the still, and the 'slops' run from the bottom of it. The mash or beer can be distilled so as to leave little if any alcohol or fusel-oil in the slops, or feed; but in general practice there is a trace of alcohol and fusel-oil left in the feed.

I have tested slops coming from a still when the instrument varied from 0 to 3 per cent alcohol. No test was made for fusel-oil. So large a per cent of alcohol as 3 per cent is unusual, and it would be found very unprofitable to the distiller. The slops are fed to the cows while hot. Each cow's ration is thirty-six gallons a day. If the water was evaporated from that quantity of slops, it would leave about twelve pounds of grain; or, in other words, there is 2,400 per cent more water than grain in the slops.

With the entire system in practice to-day, the food is not desirable for milch-cows, but it might be made so. But the sanitary conditions at Blissville and Chicago were a thousand times more harmful to the cows, and necessarily to the milk also, than the food upon which they were fed. I speak from observation of cows under good and bad sanitary conditions and care, fed on distillery slops.

The Germans would be horrified to see any kind of animals surrounded by the conditions at the places named. Europeans excel Americans in the sanitary condition and care of their stables and stock, etc.

Our general system is not only wasteful, and based on false economy, but the quality of milk is not up to a proper standard. As a matter of fact, the milk supplied to New York City is inferior (much of it is unwholesome, and unfit for use) to that of any city in Europe.

The question of still-fed milk is of little moment as compared to milk from so much greater quantity of other and more injurious feed, now in general use, and as compared to the sanitary conditions and treatment of the cows, stables, and milk, and the water the cows consume, — one of the most important elements in dairying. There is not one well in a hundred that furnishes pure water.

Brewers' and glucose grains are shipped into the country by the millions of bushels annually. Brewers' grains are good feed for milch-cows if fed the day they are produced. Glucose grains, with the sulphuric-acid treatment necessary in the factory, are injurious to both cow and milk. These grains are sent into the country wet and hot, fermenting, souring, and spoiling as they go. So the farmers' cows, with every shipment, have feed in a state of fermentation, often rotten, and fit only for the dung-hill. Distillers' slops, as fed, have undergone fermentation, while the grains are fed while fermenting, — a strong point in favor of slops.

B. M. W.

New York, Nov. 2.

Microscopic Sections of Corals.

IN *Science*, No. 248, Mr. A. F. Foerste takes exceptions to a note of mine in No. 244, and contends that the internal features of Lower Silurian monticuliporoids are not only of value in classification, but that they are the ones most worthy of study, and of almost sole use. I ask space for a brief reply.

I have, in the first part of a paper on monticuliporoids, given quotations and references showing that even by the new method of work in the corals it is not always possible to separate either species or genera. To state that this method gives 'solidity' to classification, and allows "the species to fall into easily recognized groups," is, I believe, a mistake. Dr. Nicholson, for example, in speaking of two genera, says (*Tabulate Corals*, p. 99), "There is, indeed, no feature in the way of internal construction which could be brought forward as separating *Striatopora* from *Pachypora*; and in distinguishing these two types we have to fall back upon a well-marked external character." The distinctions between *Dekayia* and *Monticulipora* are external, and not internal. Between species there is even less difference. One of Mr. Ulrich's species, for instance, is almost the exact counterpart of another: so here, again, the separation is made on external features.

My examination and study of the descriptions of the genera made by Mr. Ulrich has led me to discard all of them. The features upon which they are based are so few, so trivial, and so inconstant, that it becomes an utter impossibility to separate them with any certainty. I have not had the opportunity of seeing Mr. Ulrich's latest ideas in regard to the subject upon which he has written so much, so that I cannot tell how he may have modified or changed his conclusions. It is my belief, however, that it is impossible for one who studies the descriptions of genera and species as given by Mr. Ulrich to state positively, after he has examined a specimen macroscopically and microscopically, that he has a desired genus or species in hand.

Mr. Foerste lays stress upon the form of the cells as seen in tangential section. The same features are to be seen on the exterior, and are free from errors likely to result from sections made at a slightly different angle from the one intended. "Elevated patches of cells" cannot be recognized in internal sections in *very* many cases, as Mr. Foerste states is the case; for these are often of the same size and shape as surrounding cells. It were useless to deny the difficulty of finding specimens suitable for description. In many cases it were best had they not been described at all.

Finally, in relation to the difficulty of studying microscopic characters, I have but this to say: that it is not the difficulty itself or alone, but the unreliability of the work. I would be the last one to discard a method of work simply because it was difficult. But when it becomes difficult (and there can be no denying this, in spite of the assertion to the contrary), tedious, and uncertain, and when finally we are compelled to fall back upon external features because the internal ones fail, I contend that their use for ordinary

practical work in the field or in the study is of little or no value. I can quote no higher authority than Mr. Archibald Geikie (*Text-Book of Geology*, pp. 85-88, where elaborate directions are given for making rock sections; Professor Prestwich also considers it "an expensive and tedious process," *Geology*, i. p. 43) as to the tediousness of the process, nor a better one than Dr. Nicholson as to the uncertainty of the results (*Palaeozoic Tabulate Corals*, and *The Genus Monticulipora*). In conclusion, I can only refer to the paper on the subject by Mr. U. P. James and myself, for the full expression of my views, and I shall be happy to furnish a copy of the paper to any of those desirous of seeing these views in full for their own satisfaction.

JOSEPH F. JAMES.

Miami University, Oxford, O., Nov. 7.

Indian Names.

THE publication of the 'Early Map of the Far West,' in your last issue (*Science*, x. No. 248) gives occasion to draw attention to the changes in pronunciation which have been brought about by pedagogic conceit. 'Arkansaw' or 'Arcansaw,' of Lewis's map, gives the old pronunciation. 'Chipaway' of Lewis's map gives the true pronunciation of 'Chippewa.' 'Ojibwa' is the same word, and is pronounced 'Ojibway.' The pronunciation of 'Kansas' has not changed. It is given as 'Kansas' in Lewis's map, and 'Canzes' in the map of Louisiana by De L'Isle, eighteenth century. 'Iowa' has suffered much from the pedagogues. The polite pronunciation now is 'I-o-wah,' with the accent on the first or second syllable. The old pronunciation was 'I-o-way,' accent on the last syllable. In Lewis's map the word is found as 'Ayaouwais;' in De L'Isle's map, as 'Aiaouez' or 'Yoways.' 'Euisconsin' (Wisconsin) has fortunately remained unchanged; so has 'Pani,' which we now spell 'Pawnee.'

I once met an Indian who called himself a 'Taw-wah,' accent on first syllable. Unable to recall a tribe of such name, I had him repeat the word several times, and at length discovered an almost silent vowel before the *T*. It is Ottawa. I am not sure, however, whether this man pronounced his tribal name correctly, for he had long lived among the whites, and had gone to school. I find that tribe's name in Jeffery's map of Louisiana and Canada, 1762, given as 'Outawais,' where the final syllable is 'way.'

JOSEPH D. WILSON.

Chicago, Nov. 8.

The Temperature Sense.

IT may be interesting to those who have been acquainted with the experiments of Goldscheider, and of Dr. Donaldson and Prof. G. Stanley Hall in Johns Hopkins University, to prove the existence of a separate system of nerves for temperature, to know that the discovery was anticipated by Sir. William Hamilton. His observations of psychological phenomena seem to have been nearly as extensive as his philosophic reading. In his edition of Thomas Reid's works (vol. ii. p. 875), after commenting on a singular and exceptional case of paralysis, in which sensations of touch did not seem to be localized, he takes the occasion to hazard the conjecture, based upon observations of his own, that there is a distinct set of nerves for sensation of temperature. His language is, —

"I may notice also another problem, the solution of which ought to engage the attention of those who have the means of observation in their power. Is the sensation of heat dependent upon a peculiar set of nerves? This to me seems probable, (1) because certain sentient parts of the body are insensible to this feeling, and (2) because I have met with cases recorded, in which, while sensibility in general was abolished, the sensibility to heat remained apparently undiminished."

J. H. HYSLOP.

Baltimore, Md., Nov. 10.

Answers.

16. PENNSYLVANIA POT-HOLES. — Described in Report Z, Geological Survey of Pennsylvania, p. 111, footnote, by Professor Lesley; also in the *Scranton Republican* of Nov. 4, 1887.

JOHN C. BRANNER.

Little Rock, Ark., Nov. 7.